PRELIMINARY SPECIFICATIONS
CONSTANT VOLTAGE DC POWER SOURCE

MODEL 1210S

POWER DESIGNS

The Model 1210S is a regulated, silicon solid state DC power source suitable for use with laboratory and industrial instrumentation. It supplies 0 to 12 volts at 10 amperes and automatically limits the load current if an overload should occur. Output terminals are provided on the front and rear panels. Either the DC+ or DC- terminal may be connected to ground, allowing either positive or negative operation. The unit is very easily adapted for remote sensing (compensation for lead losses) or remote programming. A dissipation monitor provides automatic derating when remote programming is used.

ELECTRICAL SPECIFICATIONS

OUTPUT: 0 to 12 VDC, 0 to 10 amperes

INPUT: 105 to 125 V, 55 to 440 Hz, single phase, 260 W (at nominal line voltage)

OPERATING TEMPERATURE LIMITS: 0°C to 60°C

REGULATION: Better than 0.01% +2 MV for line variations of ±10% or 100% changes in rated load.

RIPPLE AND NOISE: Less than 500 μV rms at 60 Hz; less than 1 MV at 400 Hz

RECOVERY TIME: Less than 50 μsec to return to within regulation limits after a step change (1 μsec rise time) in rated load from 10% to 100% or 100% to 10%

TEMPERATURE COEFFICIENT: Better than 0.02% +2 MV per °C

STABILITY: Better than 0.02% +4 MV per 8 hour period after warm-up at constant line, load and ambient temperature

SOURCE IMPEDANCE: Less than 0.003 Ω at DC, 0.15 Ω at 100 KHz, and 1.5 Ω at 1 MHz (at rear terminals). Front terminal impedance will be approximately 50% higher.

REMOTE PROGRAMMING RESISTANCE/OUTPUT VOLTAGE RATIO: 150 Ω per volt

PROTECTION CIRCUITS: Dissipation monitoring circuit. Current limiting 0 to 10 amperes, adjustable. CAUTION: THE POTENTIAL BETWEEN ANY OUTPUT TERMINAL AND GROUND MUST NOT EXCEED 500 VOLTS.

SERIAL NO:_____

TECHNICAL DATA

MODEL 1210S

POWER DESIGNS

MECHANICAL SPECIFICATIONS

DIMENSIONS: 7-3/4" x 8-5/8" x 13-1/2" behind front panel

WEIGHT: 32 pounds

FINISH: Portable steel cabinet finished in blue vinyl enamel. Front panel is brushed, anodized aluminum with etched black lettering.

PRICE: $329.00 FOB Westbury, New York

POWER DESIGNS, INC.
1700 SHAMES DRIVE • WESTBURY, N.Y.
516 EDgewood 3-6200 TWX: 510-222-6561

POWER DESIGNS PACIFIC, INC.
3381 JUNIPERO SERRA • PALO ALTO, CALIFORNIA
415-321-6111 TWX: 910-373-1251

A D D E N D A

POWER SUPPLY

MODEL 1210S

The Electrical Parts List and/or Schematic Diagram are modified as follows:

1. Capacitor C14 is 50 uf.
2. Capacitor C18 is 4.7 uf.
3. Diodes CR8 and CR15 are part number TS121.
4. Diode CR12 is part number GI587.
5. Transistors Q1 through Q5 are part number MS1700.
6. Transistors Q6, Q7, Q8 and Q10 are part number MS2270/U.
7. Transistor Q12 is part number 2N4888 (manufacturer 98095).
8. Resistor R51, 4.7 k ohms, 10%, $\frac{1}{2}$ w, part number EB4721 (manufacturer 01121) is added between the collector of Q12 and the junction of R44 and I2 on the amplifier board.

SECTION 1
GENERAL DESCRIPTION

1-1. DESCRIPTION

The Model 1210S is a regulated DC power source suitable for use with laboratory and industrial instrumentation. The equipment supplies from 0 to 12 volts at 10 amperes and automatically limits the load current if an overload should occur. The current limiting point is adjusted by a front panel control.

Output terminals are provided on the front and rear panels of the unit. Either the DC+ or DC- terminal may be connected to ground, allowing either positive or negative operation.

The unit is very easily adapted for remote sensing (compensation for lead losses) or remote programming of the output voltage by making the appropriate connections to the rear panel screw terminals. A dissipation monitor* provides automatic derating of the supply when remote programming is used. Silicon semiconductors are used throughout for optimum temperature stability and reliability.

1-2. ELECTRICAL SPECIFICATIONS

Table 1 lists the electrical specifications of the Model 1210S.

1-3. The Model 1210S is housed in a portable, blue enamel finished, steel cabinet. The front panel is constructed of brushed anodized natural aluminum. The dimensions are weight are:

Width: 7-3/4 inches

Height: 8-5/8 inches

Depth: 13-1/2 inches behind front panel

Weight: 32 pounds.

*Patent applied for

TABLE 1. ELECTRICAL SPECIFICATIONS

Parameter	Specifications
Input power requirements	105 to 125 volts, 55 to 440 Hz, 1 Ø, 260 watts (at nominal line voltage).
Operating temperature limits	0°C to 60°C
Output Specifications:	
Voltage and current	0 to 12 volts DC, 0 to 10 amperes.
Regulation	Better than 0.01% +2 MV for line variations of ±10% or 100% changes in rated load.
Ripple and noise	Less than 500 uV rms at 60 Hz; less than 1 MV at 400 Hz.
Recovery time	Less than 50 usec to return to within regulation limits after a step change (1 usec rise time) in rated load from 10% to 100% or 100% to 10%.
Temperature coefficient	0.02% +2 MV/°C.
Stability	Better than 0.02% +4 MV per 8 hour period after warm-up at constant line, load and ambient temperature.
Source impedance	Less than 0.003 ohm at DC, 0.15 ohm at 100 KHz, and 1.5 ohms at 1 MHz at rear terminals. (Front terminal impedance will be approximately 50% higher.)
Remote programming resistance/ output voltage ratio	150 ohms/volt
Protection Circuits	Dissipation monitoring circuit. Current limiting, 0 to 10 amperes, adjustable.

CAUTION

THE POTENTIAL BETWEEN ANY OUTPUT TERMINAL AND GROUND MUST NOT EXCEED 500 VOLTS.

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SECTION 2
INSTALLATION AND OPERATION

2-1. GENERAL

The Model 1210S is a portable unit designed for bench use. Rack panel adapters are available for mounting up to three units in a standard 19-inch rack. The unit is ready for operation as shipped from the factory.

2-2. PRE-OPERATING INSTRUCTIONS

a. Connect the line cord to an appropriate AC source.

b. Rotate the CURRENT control fully clockwise.

c. Set the METER FUNCTION switch to V.

d. Adjust the VOLTAGE and FINE VOLTAGE controls until the panel meter indicates the desired output voltage.

e. The load may no be connected to either the front or rear panel DC+ and DC- terminals.

2-3. OUTPUT CURRENT LIMITING

To set the current limiting point, rotate the CURRENT control counterclockwise until the LIMIT lamp glows. Then, readjust the CURRENT control clockwise until the LIMIT lamp just goes out. The limit point is now set approximately 10% above the load current.

2-4. LOCAL AND REMOTE SENSING

a. The points to which the sensing leads are connected are the points between which the output voltage is maintained constant. Remote sensing should be used when large voltage drops are anticipated in the leads connecting the load and power supply (due to their length). Local sensing should be used when the lead resistance is known to be negligible or when the increase in regulation can be tolerated. If the voltage is sensed at the output terminals, the voltage across the load can be determined as follows:

$$V_L = V_o - I_L \times R_{LW}$$

where V_o = supply output voltage

V_L = voltage across the load

I_L = load current

R_{LW} = resistance of wires connected between the power supply and load.

b. Local Sensing: When shipped, the unit is connected for local sensing (i.e. the sensing terminals are connected to the output terminals). If remote sensing is desired, due to large voltage drops or noise pickup in the connecting wires, proceed as follows:

c. Remote Sensing: To connect the unit for remote sensing, make the following adjustments:

1. Disconnect the jumpers between DC- and S-, and S+ and DC+ terminals.

2. Connect wires from the DC+ and DC- terminals to the load, observing proper polarity.

3. Connect twisted wires from the S+ and S- terminals to the load, observing proper polarity.

NOTE

If long lengths of wire are used, it may be necessary to add adequate capacitance across the sensing points (at the load) to prevent the power supply from oscillating.

2-5. REMOTE VOLTAGE PROGRAMMING

With this feature, the output voltage of the supply can be controlled remotely. However, due to the type of regulator used in the supply, the programming range is limited by the power dissipatio in the series pass transistors. The curve printed on the rear panel of the unit shows programmable ranges for the three settings of the VOLTAGE control. For example, if the VOLTAGE control is set for an 8 VDC output, the supply may be programmed from 6.5 VDC to 8.5 VDC with a 10 ampere load or from 4 VDC to 9.5 VDC with an 8 ampere load. The dissipation monitor will automatically limit the series pass dissipation if the supply is operated outside the safe area. The LIMIT lamp will light when the monitor operates. For remote programming, proceed as follows:

NOTE

The programming terminals are sensitive to noise and hum pickup. A shielded, twisted pair of wires should be used to connect the programming resistance to the terminals. The shield must be connected to the chassis ground (G) terminal. Locate the resistor away from fields caused by solenoids, radio transmitters, etc.

a. Adjust the VOLTAGE control until the panel meter indicates the output voltage closest to that at which the supply will be programmed. Set the AC switch to off.

b. Disconnect the jumper between the RV1 and RV2 terminals. Connect the programming resistance between the RV1 and S- terminals. The correct value of this resistance can be determined as follows:

$$R_p = V_o \times 150$$

where: R_p = programming resistance in ohms

V_o = desired output voltage in volts

c. Connect the load and set the AC switch to ON. The series pass transistors will be protected for excessive dissipation by the dissipation monitoring circuit. The LIMIT lamp will light if an overload occurs.

CAUTION

DO NOT MAKE CHANGES IN THE PROGRAMMING CONNECTIONS WITH THE UNIT TURNED ON.

SECTION 3
PRINCIPLES OF OPERATION

3-1. GENERAL

The Model 1210S uses a conventional series regulator to control the output of an unregulated variable voltage DC source. The series regulator consists of a series pass section, which acts as the control element, and a high gain DC amplifier which provides the control voltage to the series pass section to maintain the output voltage at some preset level. The dissipation monitoring circuit continuously monitors the series pass section power dissipation and limits it if an overload occurs. Operating voltages for the DC amplifier and dissipation monitoring circuits are supplied by the auxiliary regulated power supply.

3-2. UNREGULATED DC SOURCE

The AC output from variable auto-transformer T3 and transformer T1 is rectified by diodes CR1 and CR2 and filtered by capacitor C3.

3-3. SERIES REGULATOR

The series pass section consists of parallel connected transistors Q1 through Q4. Base drive is provided by transistor Q5 connected to the series pass transistors as a Darlington amplifier. Transistor Q5 receives its input from high gain DC amplifier transistors Q9 and Q10. A representative portion of the DC output from the sensing voltage divider (diode CR7, resistor R48, diode CR6, and potentiometers R32 and R31) is compared at the base of Q10 with the reference voltage across zener diode CR14. An increase in output voltage will cause a decrease in the conduction of Q10 and Q9, respectively. This in turn will reduce the conduction of Q5 and the series pass transistors, and the output voltage will decrease.

Compensation for load current changes is provided by potentiometer R18 and resistor R27. Diode CR6 compensates for temperature effects. Compensation for phase shift introduced by transistors Q9 and Q10 and their associated circuitry is provided by networks such as potentiometer R23 and capacitor C6. These networks correct the gain and phase shift in the DC amplifier and thus prevent oscillation.

3-4. DISSIPATION MONITORING

Transistor Q7 monitors the voltage across the series pass transistors (via a voltage divider network consisting of R5, Q6, R14, R13, R24, and CR4). Q8 monitors the voltage across load current sensing resistor R19. Should either of these voltages rise above the level set by the appropriate potentiometer (R14 or R24 and R16), Q7 and Q8 will start to conduct and prevent the load current from rising any further. Transistor Q6 in conjunction with resistor R10 and capacitor C18 prevents the dissipation monitoring circuit from "locking-up" the supply during turn-on. When the supply is turned on, the full unregulated DC source voltage appears across the series pass transistors, momentarily (until output capacitor C10 charges to the preset output

3-5. AUXILIARY REGULATED POWER SUPPLY

The AC output of transformer T2 is rectified by diodes CR9 and CR10, filtered by capacitor C12, and supplied to a regulator circuit consisting of zener diodes CR12, CR13 and CR14 and transistor Q11. Zener diode CR12 provides a regulated 20 VDC for the semiconductors in the DC amplifier and dissipation monitoring circuit. Zener diode CR14 provides a stable reference voltage for the DC amplifier. To ensure the stability of the reference voltage during line voltage variations and temperature changes, the current through CR14 is maintained constant by the circuit consisting of zener diode CR13 and transistor Q11.

3-6. LIMIT INDICATOR

When the supply is in the current or dissipation limiting mode, transistor Q10 will be in saturation and transistor Q12 will be cut off as a result. This will allow C13 to charge and light the LIMIT lamp (I2). When Q10 comes out of saturation, Q12 will start to conduct and short out the lamp.

SECTION 4
MAINTENANCE

4-1. GENERAL

Under normal conditions no special maintenance of the power supply is required. However, the characteristics of semiconductor components do change with age and it is desirable that the adjustments and calibrations given in paragraph 4-6 be made at six-month intervals.

4-2. DISASSEMBLY

Prior to test, troubleshooting or adjustment and calibration, remove the power supply from its cabinet. The meter and amplifier boards are mounted on the right side of the chassis and are easily accessible for most maintenance purposes. If it is necessary to remove a component from either board, detach the board from the chassis frame to gain access to the rear of the board.

NOTE

When soldering or unsoldering any semiconductor components, a heat sink must be used to prevent thermal damage. A long nose pliers applied between the semiconductor and the solder joint is generally adequate.

4-3. TEST EQUIPMENT REQUIRED

Description	Mfr. and Model No.	Use
AC/DC volt-ohm-milliammeter (VOM)	Simpson, Model 260 or equivalent	General AC and DC voltage measurements during troubleshooting, adjustment and calibration
DC differential voltmeter	Keithley, Model 660 or equivalent	Precise DC voltage measurements during preliminary checks, adjustment and calibration
Ammeter, 0 to 15 amperes	Weston, Model 280 or equivalent	To measure DC current during adjustment and calibration
Oscilloscope	Tektronix, Model 545 or equivalent	General use during troubleshooting or for ripple and noise checks in accordance with specifications given in Table 1.
Rheostat, 300 ohms, 500 watts	Ohmite, Model T (connected in parallel)	Load resistor during adjustment and calibration.

4-4. TROUBLESHOOTING

Faults can be isolated rapidly by measuring the voltage at the circuit components. The schematic diagram gives the operating potentials of all semiconductors and their locations. Comparison of these potentials should be the first step in servicing the unit. Following is a rapid in-circuit check for semiconductors:

CAUTION

DO NOT OPERATE THE SUPPLY WITH ANY DISCONNECTED LEADS OR COMPONENTS. BE VERY CAREFUL WHEN SERVICING THE SUPPLY AS TRANSISTORIZED HIGH GAIN AMPLIFIERS ARE EXTREMELY SUSCEPTIBLE TO CHAIN REACTION BURN-OUTS OF TRANSISTORS, DIODES, ETC. REMOVE EXTERNAL LOAD BEFORE TROUBLESHOOTING.

If a defective semiconductor is suspected, use an ohmmeter set to its low resistance scale and measure the forward/reverse resistance ratio of each junction in the semiconductor by reversing the meter leads. A ratio of less than 1:5 indicates a defective device. It should be removed and tested on a transistor or diode tester.

NOTE

This test is not recommended for high frequency or low current devices in other instrumentation as the currents from some ohmmeters may be sufficient to damage the semiconductor junctions.

APPENDIX

1. INTRODUCTION

This appendix contains an electrical parts list, schematic diagram, parts location diagram and equipment warranty.

2. ELECTRICAL PARTS LIST

All electrical and electronic parts are listed in the sequence of their circuit numbers as shown on the schematic diagram. A brief description of each part is given, followed by the code number of the manufacturer and his part number. All manufacturers' code numbers are taken from Cataloging Handbooks H4-1 and H4-2, Federal Supply Code for Manufacturers. These handbooks are available through Federal Agencies. They may also be ordered directly from the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402.

We recommend that all parts having the code number 98095 be ordered directly from Power Designs Inc. The commercial equivalents of these parts have either wide parameter tolerances or require special factory inspection or modification before they are suitable for use in the power supply.

All components used in the power supply or supplied as replacements are carefully inspected at the factory. Inspections are performed on a 100% basis or at AQL levels in accordance with Military Specification MIL-Q-9858 under which Power Designs Inc. has been qualified.

All semiconductors are inspected on a 100% basis. They are inspected not only for operating parameters, but also for critical characteristics related to reliability and predictable life expectancy. Some of these characteristics are observed when the device is taken beyond its normal operating regions. These test techniques have been developed under a "predictable-reliability" program in operation at Power Designs Inc. for the past ten years. Under this program, quality-control procedures are constantly revaluated and updated as new advances are made in solid-state technology and additional experience is gleaned from field history.

Semiconductor manufacturers are constantly modifying their products. Complete lines are frequently discontinued to be replaced by devices having improved gain, operating voltage levels and frequency response. The high-gain, closed-loop DC amplifiers used in regulator circuits are particularly sensitive to slight changes in these parameters. Commercial or military "equivalent" transistors used as replacements may affect the power supply performance. Compliance with the original specifications can be assured if replacement semiconductors are ordered from the factory.

All replacement semiconductors are processed and stocked at the factory to insure complete interchangeability with the devices in the original equipment. To insure that proper replacements are provided, the original devices are coded with a Power Designs Inc. part number as follows:

MS	696	A
Semiconductor Manufacturer's Code	Power Designs Inc. Type	Suffix Identifying Special Parameters

When ordering replacements, please identify the device as completely as possible, listing the model and serial number if available.

In some cases, the replacement part received may have a different part number from that given in the Electrical Parts List. This can be due to several factors:

a. A different prefix indicates that Power Designs Inc. is using a different vendor source. The operating characteristics of the devices are identical.

b. A completely different part number indicates:

1. The original vendor discontinued manufacture of the item or could no longer manufacture it to the original specifications.

2. A better device for use in the particular circuit has been substituted.

3. Tighter controls for interchangeability have provided greater assurance of improved reliability with the new replacement.

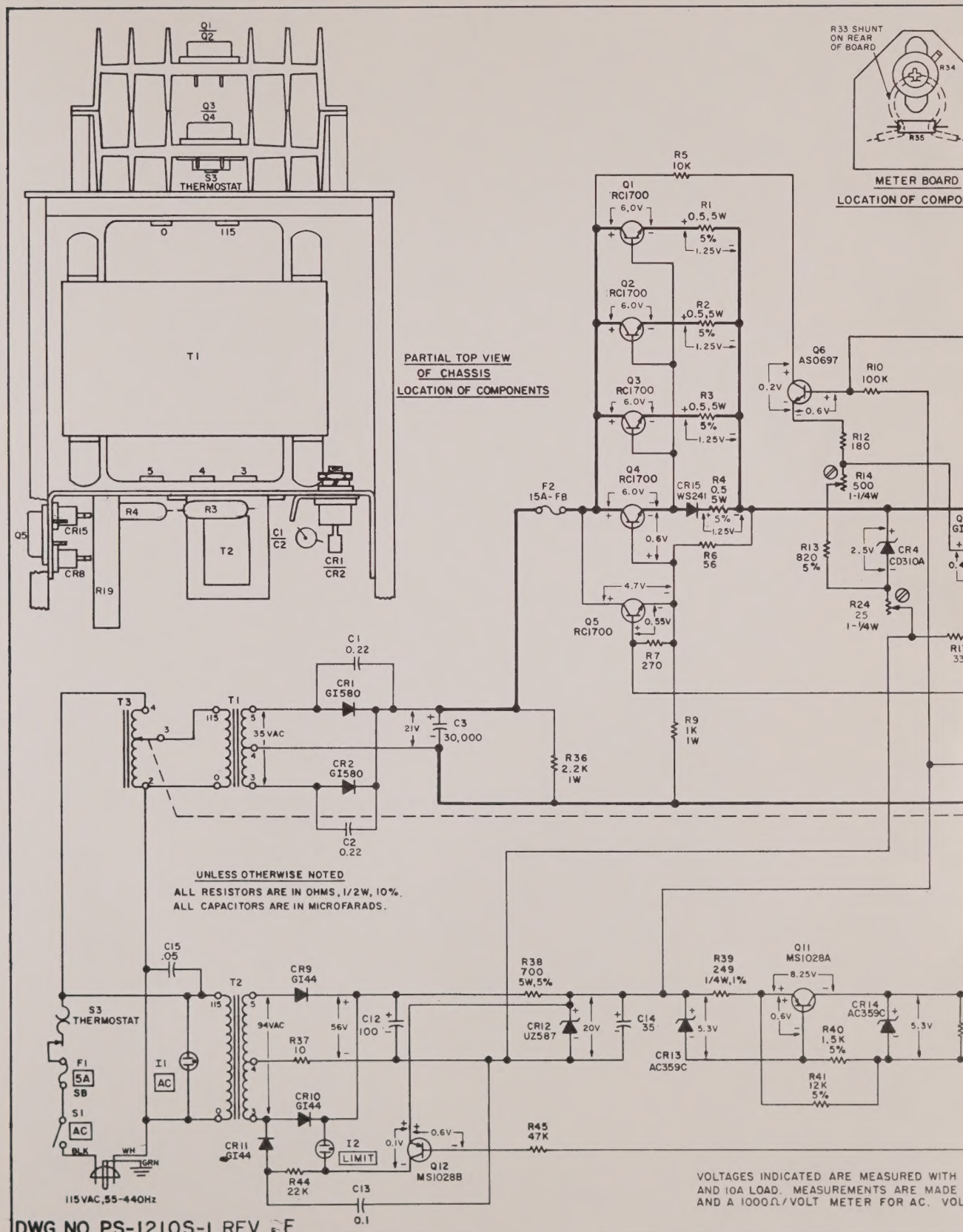
NOTE: When replacing semiconductors or investigating their part numbers, note the information in paragraph 2 above.

Circuit Number	Description	Mfr Code Number	Part Number
C1,C2	Capacitor,plastic film,0.22 uf, 80 vdc	98095	CP-29-.8
C3	Capacitor,electrolytic,30,000 uf, 25 vdc	98095	CE-37-.25
C4	Capacitor,plastic film,0.0033 uf, 200 vdc	98095	CP-18-2
C5	Capacitor,plastic film,0.1 uf, 200 vdc	98095	CP-17-2
C6,C7	Capacitor,plastic film,0.01 uf, 200 vdc	98095	CP-16-2
C8	Capacitor,electrolytic,20 uf, 100 vdc	98095	CE-103-1
C9	Capacitor,ceramic disc, 1 uf, 3 vdc	98095	CC-100M3AD
C10	Capacitor,electrolytic, 1500 uf, 30 vdc	98095	CE-153M30DT
C11	Capacitor,ceramic disc, 1 uf, 3 vdc	98095	CC-100M3AD
C12	Capacitor,electrolytic,100 uf, 80 vdc	98095	CE-91-.8
C13	Capacitor,plastic film, 0.1 uf, 200 vdc	98095	CP-17-2
C14	Capacitor,electrolytic, 50 uf, 25 vdc	98095	CE-110-.25
C15	Capacitor,ceramic disc,0.05 uf, 600 vdc	98095	CC-34-6
C18	Capacitor,electrolytic, 4.7 uf, 35 vdc	98095	CE-34-.35
C19	Capacitor,electrolytic, 10 uf, 35 vdc	98095	CE-106-.35
C20	Capacitor,ceramic disc,0.05 uf, 600 vdc	98095	CC-34-6
CR1, CR2	Diode, silicon	98095	GI580
CR4	Diode, silicon, zener	98095	CD310A
CR5 thru CR7	Diode, silicon	98095	GI44
CR8	Diode, silicon	98095	TS121
CR9 thru CR11	Diode, silicon	98095	GI44
CR12	Diode, silicon, zener	98095	GI587
CR13, CR14	Diode, silicon, zener	98095	AC359C or D
CR15	Diode, silicon	98095	TS121
F1	Fuse, "Slo-Blo," 5 amperes	71400	Type MDX
F2	Fuse, "Fast-Blo," 15 amperes	71400	Type AGC
I1	Pilot light assembly	98095	PLA-7
I2	Pilot light assembly	98095	PLA-8A
M1	Meter, dual, volt-ammeter, 0-15V/0-10A	98095	MVA-90
Q1 thru Q5	Transistor, silicon, NPN	98095	MS1700
Q6 thru Q8	Transistor, silicon, NPN	98095	MS2270/U
Q9	Transistor, silicon, PNP	98095	MS1028A
Q10	Transistor, silicon, NPN	98095	MS2270/U
Q11	Transistor, silicon, PNP	98095	MS1028A
Q12	Transistor, silicon, PNP	98095	MS1028B,MS1075
R1 thru R4	Resistor,wirewound,0.5 ohm,5%,5 w	98095	RW-005-3DA
R5	Resistor,composition,10 k ohms,10%,½w	01121	EB1031
R6	Resistor,composition,56 ohms,10%,½w	01121	EB5601
R7	Resistor,composition,270 ohms,10%,½ w	01121	EB2711
R9	Resistor,composition,1 k ohm,10%,1 w	01121	GB1021
R10	Resistor,composition,100 k ohms,10%,½w	01121	EB1041
R12	Resistor,composition,180 ohms,10%,½ w	01121	EB1811
R13	Resistor,composition,820 ohms,5%,½ w	01121	EB8215
R14	Resistor,var.,wirewound,500 ohms,10%, 1¼ w	98095	RWT-501-C4
R15	Resistor,composition,220 ohms,10%,½ w	01121	EB2211

Circuit Number	Description	Mfr Code Number	Part Number
R16	Resistor,variable,wirewound,200 ohms,10%,2w	98095	RWV201C4-.87
R17	Resistor,composition,33 ohms,10%,½ w	01121	EB3301
R18	Resistor,variable,wirewound,200 ohms,10%,1¼w	98095	RWT-201-C4
R19	Resistor,wirewound,0.15 ohms,5%,20 w	98095	RWF0015-3FF
R20,R21	Resistor,composition,15 k ohms,10%,½ w	01121	EB1531
R22	Resistor,composition,1.5 k ohms,10%,½ w	01121	EB1521
R23	Resistor,variable,wirewound,500 ohms,10%,1¼w	98095	RWT501C4
R24	Resistor,variable,wirewound,25 ohms,10%,1¼w	98095	RWT250C4
R25	Resistor,composition,680 ohms,10%,½ w	01121	EB6811
R26	Resistor,composition,4.7 k ohms,10%,½ w	01121	EB4721
R27	Resistor,composition,220 k ohms,10%,½ w	01121	EB2241
R28	Resistor,composition,6.8 k ohms,5%,½ w	01121	EB6825
R29	Resistor,precision,metal film,1.21kohms,1%,¼ w	98095	RD-1211-1QA
R30	Resistor,variable,wirewound,200 ohms,10%,1¼w	98095	RWT-201C4
R31	Resistor,variable,wirewound,3 k ohms,10%,4 w	98095	RWV302M4-5.06
R32	Resistor,variable,wirewound,20 ohms,10%,2 w	98095	RWV200C4-.87
R33	Resistor,meter shunt	98095	RWF00010
R34	Resistor,variable,wirewound,50 ohms,10%,1¼w	98095	RWT500C4
R35	Resistor,precision,wirewound,14.9k ohms,0.5%,½w	98095	RD-1492-6QA
R36	Resistor,composition,2.2 k ohms,10%,1 w	01121	GB2221
R37	Resistor,composition,10 ohms,10%,½ w	01121	EB1001
R38	Resistor,wirewound,700 ohms,5%,5 w	98095	RW-701-3RA
R39	Reistor,precision,metal film,249 ohms,1%,¼ w	98095	RD-2490-1QA
R40	Resistor,composition,1.5 k ohms,5%,½ w	01121	EB1525
R41	Resistor,composition,12 k ohms,5%,½ w	01121	EB1235
R44	Resistor,composition,22 k ohms,10%,½ w	01121	EB2231
R45	Resistor,composition,47 k ohms,10%,½ w	01121	EB4731
R46,R47	Resistor,composition,100 ohms,10%,½ w	01121	EB1011
R48	Resistor,composition,330 ohms,10%,½ w	01121	EB3311
R49	Resistor,composition,3.3 k ohms,10%,½ w	01121	EB3321
R50	Resistor,precision,metal film,3 k ohms,1%,¼ w	98095	RD-302-1QA
R51	Resistor,composition,4700 ohms,10%,½ w	01121	EB4721
S1	Switch, toggle, SPST	98095	ST-5
S2	Switch, toggle, DPDT	98095	ST-16
S3	Thermostat	98095	STH-2
T1	Transformer, power	98095	TTM-62
T2	Transformer, auxiliary	98095	TTH-27
T3	Auto-transformer, variable	98095	TTV-3

CODE LIST OF MANUFACTURERS

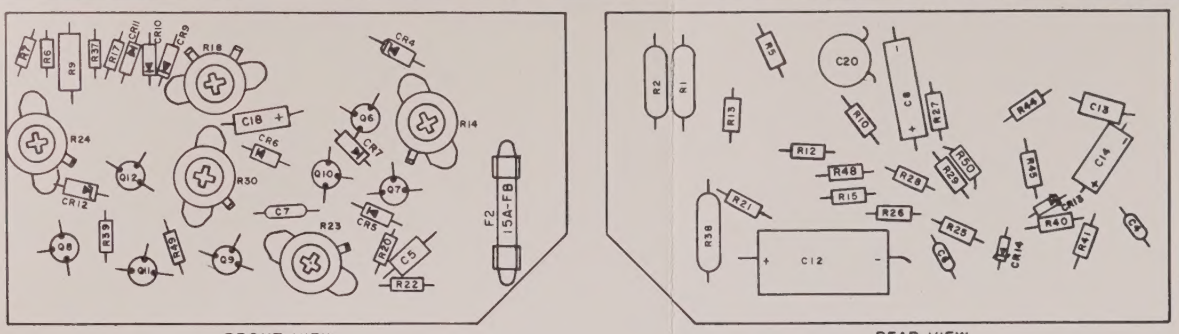
Code Number	Manufacturer	Address
01121	Allen-Bradley Company	Milwaukee, Wisconsin
71400	Bussman Manufacturing Div.	St. Louis, Missouri
98095	Power Designs Inc.	Westbury, New York



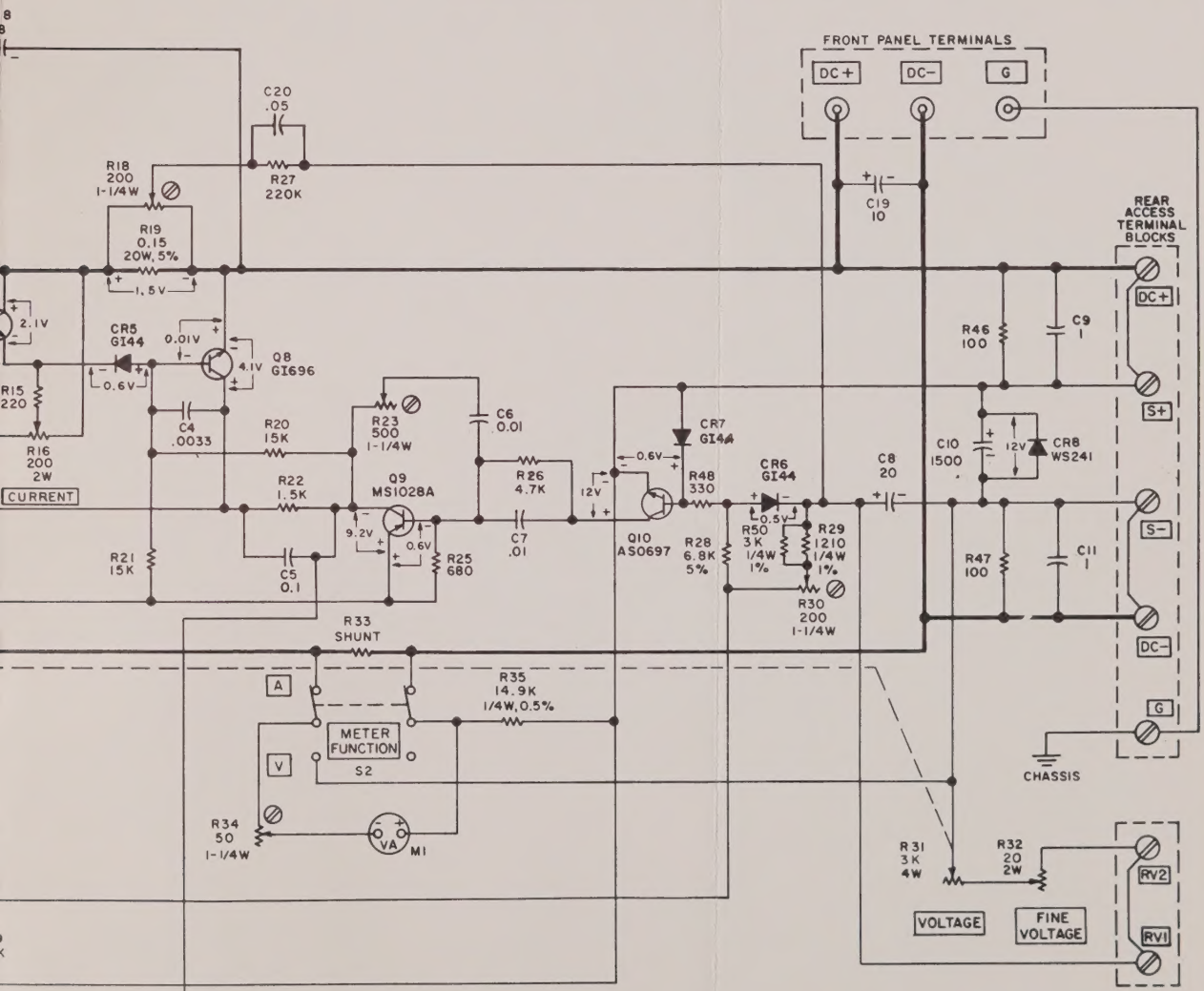
DWG. NO. PS-1210S-1 REV. F

MODEL 1210-S
TRANSISTORIZED POWER SUPPLY

0-12 VDC, 0-



LOCATION OF COMPONENTS ON AMPLIFIER BOARD



C, 60Hz INPUT WITH A 12VDC OUTPUT
H A 20,000Ω/VOLT METER FOR DC
ES ARE DC UNLESS OTHERWISE NOTED.

NOTICE
PATENTS HAVE BEEN GRANTED, PATENT APPLICATIONS ARE PENDING OR IN PROCESS OF PREPARATION ON THE PROPRIETARY PORTIONS OF THE CIRCUITS SHOWN ON THIS DRAWING. REPRODUCTION IN WHOLE OR IN PART MAY NOT BE MADE WITHOUT PERMISSION.

SYM	DESCRIPTION	APPD	DATE
F	UPDATED		7/29/66
E	REVISED, ECN 1080		6/2/66
D	REVISED, ECN 1037		4/19/66
C	UT-44R WAS UT-44		11/23/65
B	CR8 & CR15 RELOCATED TO CHASSIS LT. FLANGE		10/26/65
A	RELEASED.		10-15-65

REVISIONS

DRAWN	CHECKED	APPD.
R.A.S.		
DATE 9/14/65	DATE 10-15-65	DATE 10-15-65

POWER DESIGNS INC.
NEW YORK

WARRANTY

POWER DESIGNS INC., warrants to the original purchaser, each instrument sold by us, or our authorized agents, and all the parts thereof, to be free from defects in material or workmanship under normal use and service within the specified ratings and operating conditions.

Its obligation under this warranty is hereby limited to the repair or replacement of any instrument, or part thereof, which is returned to us within one year after delivery, and which shall prove, after our examination, to be thus defective.

This warranty does not include the cost of transportation charges to and from the factory and/or the cost of packaging or crating of instruments for return to the factory, unless such instrument is returned within thirty (30) days from the date of original shipment as shown on the packing list or shipping documents, and prior written authorization for such costs is obtained from the factory.

The repair or replacement of an instrument, or any part thereof, does not void or extend the original warranty.

POWER DESIGNS INC., reserves the right to discontinue any instrument without notice, or to make modifications in design at any time, without incurring any obligation to make these modifications in instruments previously sold.

POWER DESIGNS INC.
Westbury, L. I., New York

POWER DESIGNS PACIFIC, INC.
Palo Alto, California